A VAR description of the effects of Monetary Policy in CEECs.

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All comments and suggestions welcome.

Abstract

Can the different macroeconomic performances stated among Central Eastern European Countries (CEEC) be linked to the exchange rate regimes they set? The purpose of this paper consists in providing quantitative answers to this question using recent macroeconometric developments. More precisely, we transpose Mojon and Peersman (2001)'s VAR frameworks for euro zone countries to six CEEC: Hungary, Poland, Slovenia, Czech Republic, Slovakia and Estonia. We introduce over the 1993-mid-2003 period three models of monetary policy regime-like countries, differentiated by the degree of constraint implied by the type of exchange rate regime chosen. Therefore, considerable discrepancies in the monetary policy shocks transmission are highlighted by our study.

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1 Introduction

The now close integration into European Union (EU) of ten[1] CEECs raises crucial interrogations, both for the candidate countries and for the policymakers of the future enlarged euro area. Indeed, even more than the common market enlargement, the adoption of euro by these countries represent a major macroeconomic challenge for the European Monetary Union (EMU). European Central Bank (ECB)'s strategy focuses on price stability, defined by the Governing Council as an "inflation rate close to 2% over the medium term". However, this target may become quickly inadequate for the 27 countries monetary union. Although inflation in candidate countries considerably decreased compared to the transition era, Bénassy-Quéré and Lahrèche Révil (2001) emphasize that some catching-up inflation is likely to persist when adopting the common currency. This phenomenon could therefore raise the aggregate euro zone inflation by 0.25 to 0.75 percentage points, according to Bénassy-Quéré and Lahrèche Révil (2001)'s calculations. Confronted to this situation, the strict mandate of the ECB could therefore lead her to set an over-restrictive or even a deflationary monetary policy in order to maintain average euro zone inflation below 2%, with obvious risks for economic growth and welfare. But more generally, an additional uncertainty comes from the ignorance of ECB monetary policy decisions impact on these countries. Of course, almost all empirical studies on monetary policy transmission show that a contractionary monetary shock leads to a temporary fall of output and a progressive decline in prices. At least for developed areas like the United States or Western Europe countries. But how long does the contraction of GDP last in CEECs? How much time is needed for an interest rise to slow down inflation in these countries? The lack of answers to these questions is obviously problematic in the context of

[1] Cyprus, Malta, Estonia, Hungary, Lettonia, Lithuania, Poland, Czech Republic, Slovakia and Slovenia.

EMU: how can euro zone central bankers set properly interest rates if they do not have an idea of consequences for the newcomers - and so, the potential implication for the a whole area?

The knowledge of monetary policy transmission mechanisms for CEECs is therefore essential for the implementation of the Eurosystem's monetary strategy. Of course, an attempt to assess potential evolution of monetary policy transmission mechanisms *after* the integration of theses countries in the euro zone would have been highly random. However, as emphasized by Clausen and Hayo (2002) concerning Western EMU members, the modification of transmission mechanisms impelled by monetary integration should take place very progressively. As a consequence, empirical studies on current and past experiences of these countries can still provide useful information on monetary policy transmission under EMU, especially now their macroeconomic environment is mainly stabilized.

Thus, this paper provides empirical descriptions of monetary policy transmission mechanisms for six CEECs: Estonia, Hungary, Poland, Czech Republic, Slovakia and Slovenia[2], using *Vectorial Auto Regressive*(VAR) models. More precisely, our contribution is threefold. First, following the path of Mojon and Peersman (2001) for Western EMU members, we do not use exactly the same specification for all the countries. In order to assess properly cross-country differences in the transmission mechanism, we set up discriminated VAR schemes over our sample-period (January 1993 to June 2003), accounting for the different exchange rate regimes adopted by these countries; that way, the constraint lying on each national monetary policy will be much better modelled than in an abstract uniform VAR specification. To our best knowledge, this is the first time that such an approach is adopted for some CEECs.

[2]The choice of these countries was motivated both by their potential close integration into the euro area and data availability.

Second, the partition in two of our sample period will allow to assess the differences between the transition and the stabilization period. Third, the use of a monthly database of four endogenous variables helps to strengthen greatly the robustness of our results. Eventually, the remainder of the paper is structured as follows: section 2 provides a short overview of theoretical underpinning and related literature. Afterwards, section 3 sets up our discriminated VAR specifications and section 4 addresses related econometric concerns. In section 5, the results produced by their completion are presented and discussed Eventually, section 6 provides concluding remarks.

2 Monetary Macroeconomics for CEECs

The seminal article by Sims (1980) initiated numerous studies using VAR specifications in order to analyze monetary policy effects in the United States (for comprehensive reviews of VAR-literature focused on American economy, see Leeper et al., 1998, or Christiano et al., 1998). While relying on a parsimonious set of variables, structural VAR models show indeed very good abilities to study economic fluctuations and more generally good identification properties. When the adoption of Maastricht Treaty turned to a reality the perspective of European monetary integration within the decade, structural VAR approaches got extensively applied to European countries, mainly to identify and compare the nature of supply and demand shocks and their degree of asymmetry (see especially the major contributions by Bayoumi and Eichengreen, 1993a&b). Most of these investigations used to perform analysis in terms of Optima Currency Areas (OCA) theory, in order to asses the desirability of EMU. However, when it appeared that monetary union was almost sure, VAR studies turned to the question of potential asymmetries in monetary policy transmission across EMU members (Mojon and

Peesman, 2001, review VAR studies focusing on monetary policy and the individual countries of the Euro area.).

Despite undeniable virtues on the empirical ground, VAR framework has been hardly applied to CEECs until today. Only three VAR-studies were devoted to demand/supply shocks analysis (Frenkel et al., 1999; Hovarth, 2000; Frenkel and Nikel, 2002) and none of them to an explicit investigation of monetary policy transmission in these countries. Actually, both the lack of long enough time series and the transition process, preventing the emergence of stable relationships between macroeconomic variables, made problematic the use of VAR approach.

However, these problems do not seem insuperable anymore. Regarding the first one, sufficiently long data for prices, interest rates and industrial production are now available in monthly frequency, which strengthen greatly econometric analysis robustness. The second one can be partly addressed by skipping the first three years of transition, when the structural changes suffered by Eastern economies lead to major disturbances in the data. So, a VAR-study on Eastern country starting in 1993 seems really feasible and relevant, especially if we consider,like Frenkel and Nickel (2002), that data quality greatly improved during the early 90's.

So, the problem lies more in the VAR specification, which appeared to us much more decisive for any cross-country comparison of the transmission mechanisms. However, following the path of most of the literature regarding Western Europe countries, the couple of VAR studies already carried out on CEECs use the same identification scheme for all their sample. So, Frenkel and Nickel (2001) use a very simple specification, with only output and prices. This undiscriminated approach did not seem relevant for assessing monetary policy shocks impacts on CEECs, because it does not model exchange rate regimes constraint on these countries. Indeed, the latter is likely to have set different monetary policy regimes for each country. It is for example highly probable that Estonia, who has been supporting a currency board (with euro, Deutsche Mark) for several years, did not enjoy the same flexibility of monetary policy than Slovenia, who experienced managed floating since 1993. More generally, Masson (1999) emphasized in an exhaustive way the crucial trade-off faced by CEECs when choosing their exchange rates regime, and the consecutive uncertainties surrounding monetary policy in these countries.

As a consequence, we support the idea that it is impossible to model correctly monetary policy transmission in the CEECs without accounting for exchange rates different regimes. By making such an assumption, we follow explicitly the idea Mojon and Peersman (2001) formulated for Western European Countries : the DM supremacy inside the EMS created different monetary policy regimes that could not be represented in in the same identification scheme. Moreover, regarding the specific situation of CEECs, we have to keep in mind that these countries went through a very special period during the nineties, when following the transition process to free market economy. Indeed, all of them suffered at this time from a great period of macroeconomic instability, which was likely to have created distortions of monetary policy transmission mechanisms. So, our sample period will be divided in two sub-periods during the analysis. The first one starts in 1993 and ends in 1998, with the Russian crisis, considered implicitly as the last transition jolt. Consequently, the second one, understood as a stabilization period, begins in 1999 and ends in June 2003, when our data set stops.

So, this paper wants to implement a monetary policy identification scheme accounting both for the exchange rate regime constraints for our six countries and for the problems caused by the transition period. This will allow to perform two different kind of comparisons, a cross-country one and a cross-period one. The next section turns into the details of our identification schemes.

3 Identification schemes for CEECs

This section discusses the details of our VAR frameworks. The purpose is to provide discriminated specifications sufficiently different to fit the individual countries experiences, but also sufficiently close for the sake of results comparability. Transposing Mojon and Peersman (2001)'s framework, our challenge consists in providing three identification schemes able to model the diversity of regimes among our sample, while being robust to the numerous switches suffered by a majority of countries during the period 1993-2003. Our VAR specifications are built therefore around the degree of constraint exerted by the exchange rate regime on monetary policy. All of them will take the following shape:

$$Y_t = \sum_{i=1}^{n} A_i Y_{t-i} + BX_t + \mu_t \qquad (1)$$

In this benchmark model, the endogenous variables, Y_t, consist of seasonally adjusted industrial production y_t (understood as a proxy of real GDP), consumer prices π_t and the short term interest rate r_t. μ_t is a vector of innovations and X_t the vector of exogenous variables. The latter will therefore vary according to the three levels of exchange rate constraint we define: strong, average (or intermediary) and weak. Of course, some countries may switch from a category to another, depending on the considered sub-period - transition or stabilization.

3.1 The strong constraint regime

The strong constraint specification turns typically to the currency board regime, and will consequently focus on Estonia. Indeed, this country has been maintaining since 1992 a strict fixed parity regime, first with DM then with euro. Such a rigid fixed exchange rate regime implies that, in Estonia, the scope for an autonomous monetary policy was extremely limited over both sub-periods. Of course, one could argue that none of CEECs has ever had a wide scope for autonomous monetary policy since transition process began. Remember, however, that we are interested in the *relative* degree of constraint compelled by the exchange rate regime. In other words, we presume that Estonia is comparatively more constrained than the other countries of our sample.

Consequently, we consider that most of the monetary policy shocks during 1993-1998 (respectively 1999-mid-2003) are likely to be driven by the German (respectively European) interest rate. Furthermore, Estonia is a small country, so we presume that it is strongly influenced by economic conditions in Germany. Eventually, relying on a standard hypothesis for small opened economies, we assume that there is no feedback from the smaller country to Germany (resp. euro zone). For Estonia's VAR specification, German (resp. euro zone) industrial output, prices and interest rates are included in the vector of exogenous variables. Formally, for the interval 1993-1998, we have:

$$X_t^{EST} = [y_t^{GER} \quad \pi_t^{GER} \quad r_t^{GER}] \tag{2}$$

and for 1999-mid-2003:

$$X_t^{EST} = [y_t^{EUR} \quad \pi_t^{EUR} \quad r_t^{EUR}] \tag{3}$$

3.2 The average constraint regime

A number of CEECs knew several exchange rates regime during the nineties (cf. appendix one). Most of them tried to maintain more or less a fixed parity against DM and/or dollar (or at least, opted for a crawling peg) until the late nineties, when the combined pressures of Asian and Russian crisis put an en end to rigid exchange rate regimes, leading to an almost generalized floating for the five other countries of our sample. For the 1993-1998 period, two different sets of variables are compose the exogenous block: bilateral US end DM exchange rates inclusion model directly the exchange rate objective, while German and American interest rates inclusion symbolizes the constraint on national monetary policies. Formally, with j = Czech Republic, Hungary, Poland and Slovakia, this leads to:

$$X_t^j = [q_t^{US} \quad r_t^{US} \quad q_t^{GER} \quad r_t^{GER}] \tag{4}$$

The second sub-period is characterized by much more flexible exchange rates regimes, especially after 2000. However, this is far from meaning a complete freedom of action for the monetary authorities. Indeed, while Hungary still maintains wide margins of fluctuations with euro (+/-15%), Czech republic and Slovakia Central Banks intervene regularly on FX markets with euro as an implicit reference. Consequently, for the 1999-mid-2003 period, bilateral parity with euro and euro zone interest rates are still included in the block of exogenous variables. So, for k = Czech Republic, Hungary and Slovakia, the exogenous block becomes:

$$X_t^k = [q_t^{EUR} \quad r_t^{EUR}] \tag{5}$$

As one can see, Poland does not belong to the average constraint group for the second sub-period: this is explained below.

3.3 The weak constraint regime

The weak constraint regime concerns Slovenia for the whole period, 1993-mid-2003. Actually, since October 1991, Slovenian Tolar is in managed floating, while monetary policy accounts only for internal objectives - mainly the convergence of inflation toward euro zone level. This latter objective means that European Central Bank interest rates setting remains especially important for Slovenian monetary authorities; consequently, euro zone interest rate remains the only exogenous variable in Slovenia VAR model, for the whole period:

$$X_t^{SLV} = [r_t^{EUR}] \tag{6}$$

Since April 11, 2000, Poland switched from a wide-margined crawling peg to a managed floating close to the Slovenian one. That is why we believe that, for the 1999-mid-2003 sub-period, a weak constraint specification fits more the Polish situation than the average one. Poland identification scheme is formalized as follows for the second sub-period.

$$X_t^{POL} = [r_t^{EUR}] \tag{7}$$

As one can see, this three-staged discrimination schemes sound like a simplification of the 1 to 8 exchange rate regime classification that can be found in Babetski *et al.* (2003). In that spirit, the strong constraint regime would correspond to categories 1 and 2 (dollarization and currency board), while the weak constraint regime is related to categories 7 and 8 (managed and independent float). Consequently, the average constraint classification matches exchange rates from fixed to crawling pegs.

4 Time series properties of the data : some controversial issues

This section turns to econometric concerns regarding the estimation of our 12 ($= 6 \times 2$) VAR models. First, the database consists of monthly series of industrial production, consumer prices, interest rates and nominal exchange rates from 1993:1 to 2003:6. They mainly come from Eurostat, IFS (International Financial Statistics, IMF database) and datastream, and episodically from national statistical institutes. The data are seasonally adjusted logs, except the interest rates which are in levels. Regarding the latter, we use the three-month interest rate as the monetary policy rate as this the only short-term interest rate that is available for all countries over the whole sample period.

Before proceeding to estimations, we have to check out carefully time series properties. Indeed, Mojon and Peersman (2001) estimate directly each of their VAR in levels, assuming - but not testing -"implicit cointegrating relationships between the data". However, if this hypothesis is not confirmed, regressions in level between non-stationary and non-cointegrated variables are systematically spurious, a danger recently emphasized by Österholm (2003). That is why we proceed to explicit tests for stationarity and - as far as it is possible - cointegration for this study focusing on CEECs.

4.1 Stationarity tests : the puzzle of integration order

We first focus on the persistence of the endogenous variables. For this purpose, two different tests are provided, ADF (Augmented Dickey-Fuller) and KPSS (Kwiawtowski, Phillips, Schmidt et Shin, 1992)[3]. The ADF test is the most commonly used, and has been preferred by a significant majority of studies to other tests with unit root under the null hypothesis. The KPSS test, which has stationarity under its null, is proceeded for confirming or cancelling ADF tests results. The KPSS test is performed with a Bartlett kernel where the bandwidth parameter is selected using the Newey and West (1994) automatic parameter method.

Tables 1 and 2 give the results, as tests statistics, for the unit root tests for all countries and the two sub-periods. Concerning the first sub-period, both tests generally agree that monthly interest rates and industrial production are integrated of order one. Results for *ipa* must be considered carefully however, as the low Durbin-Watson (DW) statistics highlight some autocorrelation problems. Conversely, ADF and KPSS tests reach conflicting results for consumer prices : while ADF test supports the single unit root hypothesis (except for Hungary, for which ADF finds two unit roots), KPSS finds that *cpi* are I(2) for all countries.

The results for the second sub-period are more homogeneous : both tests find that the three variables for all the countries exhibit *at most one unit root*. For Czech Republic and Poland, ADF test even concludes that *cpi* could be considered as stationary, at 1% significance level ; however, the low DW statistics reported for these tests cast some serious doubts on their robustness.

[3] Here, we follow explicitly the *modus operandi* proposed by Österholm (2003)

Table 1: Results from unit root tests on individual series for the 1993:1-1998:12 period

	Czech Rep.	Estonia	Hungary
	ADF KPSS	ADF KPSS	ADF KPSS
cpi_t	-3.68** 0.067	-3.72* 1.065*	-2.79** 1.1279
Δcpi_t	-3,115*** 0.706*	-9,563*** 0.667***	-3,588** 0.089*
	.	.	.
	ADF KPSS	ADF KPSS	ADF KPSS
ipa_t	-2.88*** 0.162**	-2.38 0.136*	-2.11 0.174*
Δipa_t	-2,884* 0.146***	-4,497*** 0.110*	-12.9*** 0.09*
	.	.	.
	ADF KPSS	ADF KPSS	ADF KPSS
mir_t	-2.52 0146**	-1.49 0.197**	-1.54 0.26***
Δmir_t	-5,627*** 0.146***	-5,734*** 0.197***	-8,109** 0.098***
	Poland	**Slovakia**	**Slovenia**
	ADF KPSS	ADF KPSS	ADF KPSS
cpi_t	-0.977 0.347	-0.54 0.255	-3.87*** 0.264
Δcpi_t	-3.435*** 0.125**	-3.764** 0.084*	-5,743*** 0.160***
	.	.	.
	ADF KPSS	ADF KPSS	ADF KPSS
ipa_t	-2.83 ** 0.167	-1.943 0.145	-2.01 0.118
Δipa_t	-13.894*** 0.167***	-5.11*** 0.144**	-6,38*** 0.076*
	.	.	.
	ADF KPSS	ADF KPSS	ADF KPSS
mir_t	-3.04 0.057	-1.972 0.133***	-1.94 0.227**
Δmir_t	-12,859*** 0.466***	-8,306*** 0.596***	-2,429** 0.227***

Notes: $***$,$**$, and $*$ respectively denoting significance at the 1%, 5% and 10% levels.

Table 2: Results from unit root tests on individual series for the 1999:1-2003:6 period

	Czech Rep.		Estonia		Hungary	
	ADF	KPSS	ADF	KPSS	ADF	KPSS
cpi_t	-3.090***	0.823	-1,403***	0.170*	-1,902***	0.244
Δcpi_t	-5,099***	0.302***	-5,24***	0.127**	-4,533***	0.062***
	.		.		.	
	ADF	KPSS	ADF	KPSS	ADF	KPSS
ipa_t	-1,389***	0.823	-0,629*	0.153*	-3,576***	0.447**
Δipa_t	-5,794***	0.302***	-11,986***			
	.		.		.	
	ADF	KPSS	ADF	KPSS	ADF	KPSS
mir_t	-2,784***	0.125**	-0,657*	0.149*	-1,563**	0.895
Δmir_t	-3.18**	0.167**	-10,336***	0.182**	-7,963***	0.089***
	Poland		Slovakia		Slovenia	
	ADF	KPSS	ADF	KPSS	ADF	KPSS
cpi_t	-4,613***	0.253*	-1,6***	0.962	-1,005	0.878
Δcpi_t	-3,91***	0.061***	-6,01***	0.184***	-7,55	0.168***
	.		.		.	
	ADF	KPSS	ADF	KPSS	ADF	KPSS
ipa_t	-1,738***	0.159**	-3,632***	0.062***	-2.828***	0.760
Δipa_t	-11,766***	0.116	-3.39**	0.054	-1.75*	0.129***
	.		.		.	
	ADF	KPSS	ADF	KPSS	ADF	KPSS
mir_t	-1,317***	0.509*	-1,266***	0.763	-3,385***	0.548*
Δmir_t	-10,612***	0.456**	-6,312***	0.085***	-8.86***	0.077

Notes: $***$,$**$, and $*$ respectively denoting significance at the 1%, 5% and 10% levels.

Therefore, we can reasonably consider that interest rates and industrial production are I(1) over both sub-periods. Prices situation is more ambiguous, as ADF and KPSS results clearly conflict, at least for the 1993:1-1998:12 period. Both test weaknesses are well-known. ADF limited power has been widely highlighted across the literature (see for instance Clarida et al., 1998), while KPSS results have to be considered carefully, given the potential autocorrelation problems (DW statistics regularly between 1 and 1.5). Considering that significance levels are generally better for ADF than for KPSS tests, we eventually decided to presume that consumer prices indexes are I(1) for all countries on both sub-periods. *As a consequence, our three endogenous variables, ipa, cpi and mir are all three considered as integrated of order one.*

4.2 “Long-term" relationships

Consequently, implementation of cointegration tests is consistent and makes sense from a statistical point of view[4]. We proceed as follows: Johansen trace and eigenvalue tests at 5% confidence level is applied for all endogenous variables of our VAR, that is output, price and interest rates. Number of cointegrating vectors are reported in table 3 and 4 below:

Table 3: Johansen Trace test: number of cointegrating vectors

	Czech Republic	Estonia	Hungary	Poland	Slovakia	Slovenia
1993:1-2003:6	1	1	1	1	0	2
1993:1-1998:12	1	2	2	1	2	2
1999:1-2003:6	2	1	2	1	1	1

[4] This question is of course more controversial on the economic ground: can we talk of long-term relationships for 5 or 10 years series? Anyway, we must presume a positive answer to this question, otherwise, no econometric work can be decently proceeded

Table 4: Johansen eigenvalue test: number of cointegrating vectors

	Czech Republic	Estonia	Hungary	Poland	Slovakia	Slovenia
1993:1-2003:6	0	1	1	1	0	2
1993:1-1998:12	1	0	2	1	2	2
1999:1-2003:6	1	2	2	2	1	1

So, Johansen cointegration tests corroborate the existence of at least one cointegrating vector for each VAR model, except for Estonia. Regarding the latter, Trace and eigenvalue tests disagree about the existence of one cointegrating vector. Considering the well-known limited power of cointegration tests, we will perform the regressions for Estonia assuming implicitly the existence of at least one cointegrating vector. Therefore, the existence of long-run relationships is mostly proved, and we can estimate the VAR in levels without running the risk of spurious regressions. Eventually, regarding the lag-order of the regressions, we chose the one allowing to obtain non-correlated and normal residuals for each of the VARs' equations. This number usually turns out to be of order five or six.

5 Estimations: discussion of the results

The results of our three discriminated identification schemes for each of the six CEECs are shown in appendix II, Graph 1 & 2(for 1993:1-1998:12) and Graph 3&4 (for 1999:1-2003:6). These graphs depict for each of the individual countries the effects of a one-standard deviation monetary policy shock (understood as a variation of domestic interest rates) on domestic industrial production and domestic consumer prices. We report the OLS estimates based impulse reaction function together with 95 percent confidence bands. Graph 1 and 2 highlight that in general, a monetary policy tightening eventually leads to a fall in prices, sometimes after a short period of “price puzzle"[5]. Results are more mitigated regarding output, for which response functions are much more notable and less significant: this might come from the well-known structural instability of industrial production, more sensitive to seasonality than gross domestic product. Nonetheless, it is already interesting to notice that these fairly simple identification schemes gives consistent responses of prices to monetary shocks, at least for a majority of countries. However, some additional problems and specific features are to emphasize.

5.1 Output evolutions

Regarding output, responses to monetary policy shocks are on the whole very unstable, especially for the 1993-1998 period. For Estonia, the erratic industrial production path does not provide any real information. The potential problem of spurious regression emphasized previously seems to be confirmed: indeed, the lack of cointegration between non-stationary series could explain the chaotic behavior described by Figure 1. For Slovenia and Hungary, we face a temporary output puzzle: industrial production increase after interest rate increase, respectively by 20 and 60 basis points. But after the 10^{th} month, Slovenian and Hungarian industrial productions behave differently: while Slovenian output falls quickly, loosing until 20 points around the 14^{th} month, the Hungarian one decreases slowly and stabilize around a new equilibrium level, by 10-15 points lower than the initial one. Czech Republic and Slovakia exhibit the same profile, with a quick and moderate decrease of 30 basis points the 3^{rd} and 5^{th} month; afterwards, output comes back quickly to its long-run level, reached between the 4^{th} and 5^{th} trimester. Poland's industrial production suffers from an erratic evolution but seems

[5] the price puzzle refers to a situation where a monetary tightening is followed by a price increase.

to converge after six or seven trimesters.

Does the situation change during the stabilization period (1999-mid-2003)? Estonian industrial production follows now a more readable path, telling us that output falls only by 20 basis points around after 6 months, and is back to is equilibrium level after 4 or 5 trimesters. While Slovakia exhibits a strange profile of "up and down" evolutions with no clear trend toward equilibrium level, Czech output evolution is totally random until the 5^{th} trimester. At the opposite, Poland seems to suffer strongly from a monetary policy shock: its output falls by 70 basis point after the 7 month, and does not reach a level close to equilibrium before 5,5 years. Hungary shows an even more violent (and consequently too strong to be credible) reaction of its output, which falls by 200 basis points after three months, before converging to equilibrium around the 5^{th} trimester. Conversely, Slovenia is the most insensitive to monetary tightening: the lowest point is reached after six months, where output has decreased by only ten percentage points, while the convergence toward equilibrium is achieved after one year.

5.2 Price evolutions

Results for prices are much more satisfying and in line with what one could expect, even for the transition period. Thus, apart from Czech Republic (trapped in a price puzzle), all the other countries exhibit a gradual and significant decline in prices after a restrictive monetary shock. Even more remarkable is the striking homogeneity of the prices contraction width (between 15 and 40 basis points). Nonetheless, the time for adjustment is quite different from one country to another, varying between 2 and 5 trimesters. Anyway, the five consumer prices indexes converge on the long run to a new equilibrium level which is lower than the initial one : they are between 2 and 20 basis points inferior. This is a quite important (and somewhat comforting!) lesson for the ECB.

Regarding the stabilization period, there is no big noticeable change - the best example, being Slovenia, whose prices behave exactly the same way than the previous period. We can however notice that Estonian prices decrease less after a monetary shock, and their convergence to the new lower equilibrium level is quicker. Besides, even if its evolution remains quite chaotic, Czech inflation behaves much more normally than during the previous period, as they also reach a smaller equilibrium level. On the whole, prices of our six countries decrease by 20 to 25 percentage points, after four to seven trimesters.

6 Conclusion

The purpose of this paper consisted in analyzing monetary policy transmission for six Central and Eastern European Countries (CEEC). Relying on discriminated VAR models, we wanted to account to the specific constraints implied by the different exchange rates regimes. Furthermore, the separation between a transition (1993-1998) and a stabilization (1999-mid-2003) period helped to gauge possible evolutions for the different countries.

Our specifications give on the whole better results for prices than for output. As a consequence, we aim to improve our identification schemes in two directions. First, we have to account for possible misidentification of output dynamic and consequently look for new variables, exogenous or endogenous, that could be integrated in our framework. In that spirit, regressions based on quarterly data including gross domestic product should help to distinguish what comes from output dynamics misspecification and from industrial production instability. Second, alternative specifications with inclusion of money in endogenous group could be tested, accounting for the fact that Central Banks might not control inflation using interest rates, but money supply.

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Table 5: Exchange regimes

Country	Exchange regime	Referential Exchange rate	CB Intervention	Exchange Rate Evolution
Estonia	Currency board (since June 1992)	15,64 for 1 euro (1st January: 8 EEK /1 DM)		1992: currency board with DM. 1993: total convertibility of th balance of payment. 1st January: 15,64 EEK/1Euro.
Hungary	Crawling peg with +/- 15% fluctuations bands since(October 2001)	Exchange rate indexed on the Euro(276,1 HUF = 1 EURO) +/- 15%		9 December 1991: adoption of the fixed exchange rate regime bu adjustable with a basket devises: dollar (50%), ecu (50%). Fluctuatio Bands: +/- 1,25%; 2 August 1993: DM replace ECU; 16 Ma 1994: basket modification 30% dollar and 70% ecu ; 23 Decembe 1994: widening of the bands with +/- 2,25%; 12 Mars 1995: forint devaluation with 9% and adoption of the crawling peg with a baske devises: US (30%)and ECU (70%); Initial devaluation rate is 1.9% pe month; 1st January 1997: DM replace Ecu. 1st January 2000: baske adoption with only one currency; 1st October 2001: abandonment o the monthly devaluation of 0,3% in place since April 2000.
Slovenia	Managed Floating (October 1991)		Daily Interventions	8 October 1991: administrate floating; October 1999: long term liberalization; of the capital movements.
Slovakia	Managed Floating (October 1998)		Increasing Interventions	28 December 1990: internal convertibility of the czech Koruna; Curren cies basket: 31,34% (USD), 45,52% DM, AUT Schilling (4,24%)Britis lire (4,24%) et Swiss Franc;(6,55%); Swiss Franc(6,55%)Februar 1993: introduction of the Slovak Koruna. 10 July 1993: devalua tion of the currency with 10%. July 1994: new basket of currencie Installation of the fluctuation bands: +/- 1.5%. October 1998: Floatin
Czech Rep	Managed Floating(27 May 1997)		Daily Interventions	December 1990: internal convertibility of czech koruna. 8 Februar 1993: Introduction of czech koruna. May 1993: Changes in th composition basket; 28 February 1996: widening of the fluctuatio bands with: +/- 7,5%. May 1997: free floating because of the czec crises.
Poland	Managed Floating(11 April 2000)		Central Bank reserves the rights to intervene smooth the	Since 1st January: anchoring the national currency to the USD Devaluation: 46,2%. Internal convertibility of the Zloty. 17 May 1991 adoption of a basket with 5 currencies. 15 October 1991: adoption o the crawling peg regime. 25 February 1992 and 27 August 1993: Zlot devaluation (12% and 8,1%). 1st January: zloty redetermination new Zloty = 10000 Zlotys. 16 May 1995: widening of the fluctuatio

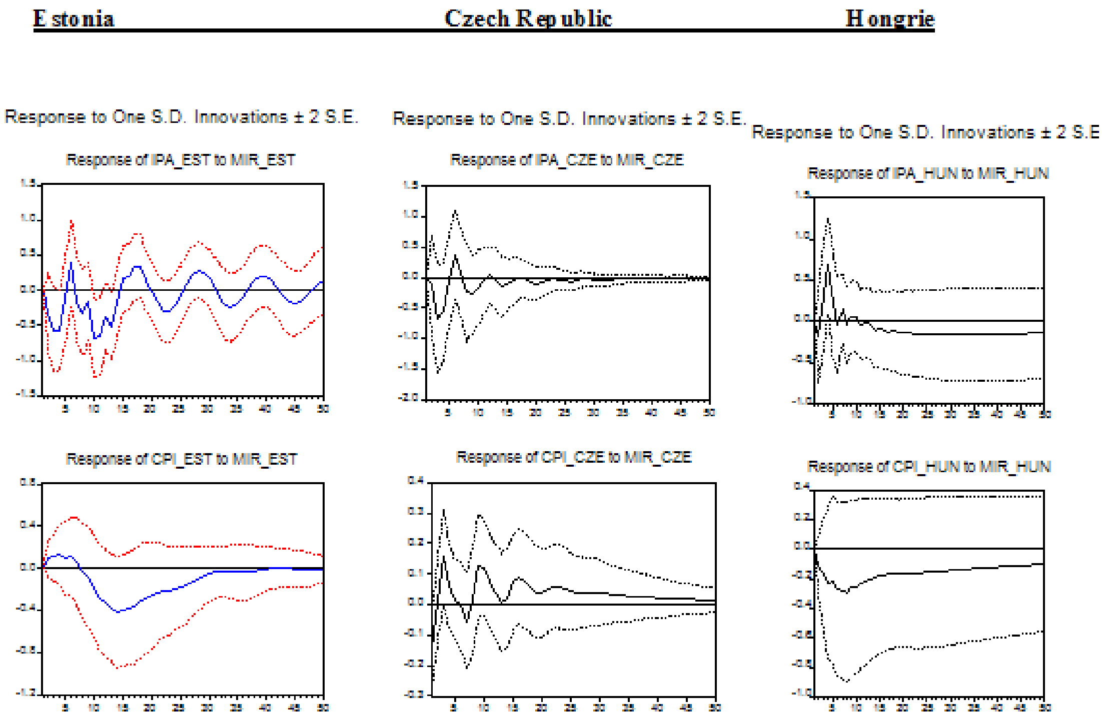

Figure 1: **Appendix IIa: Transition period 1993-1998**

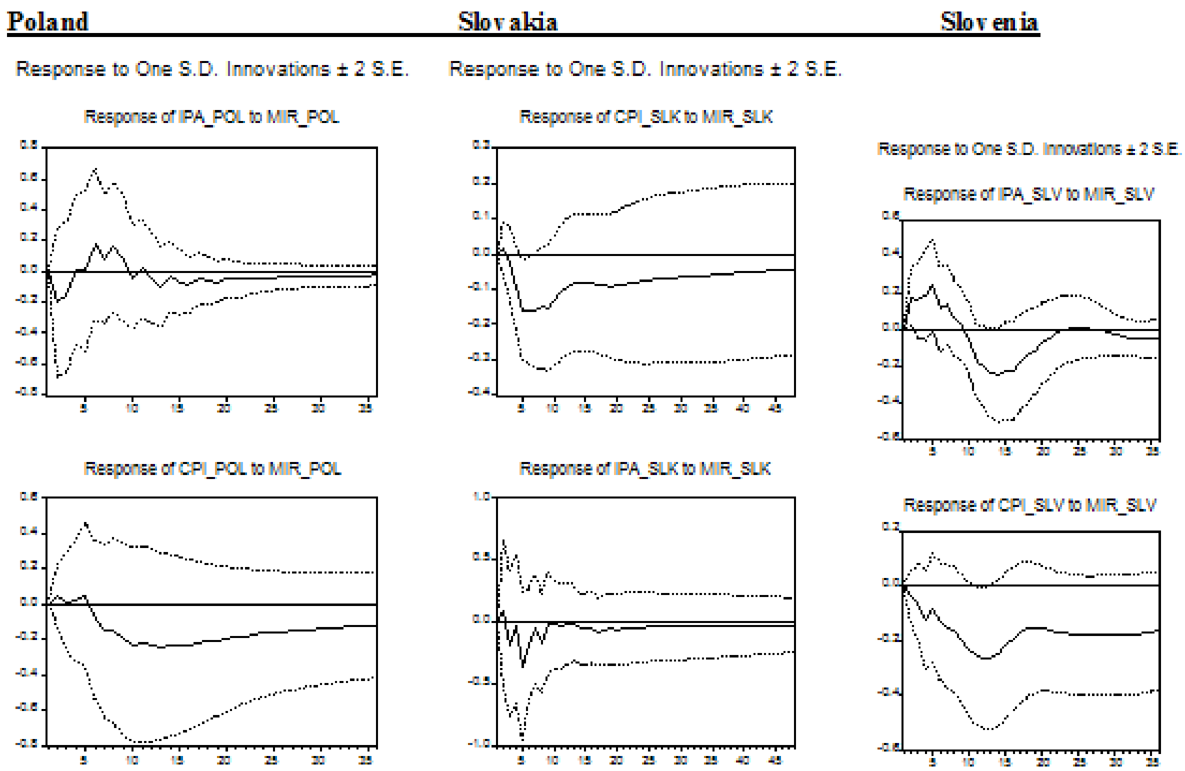

Figure 2: **Appendix IIb: Transition period 1993-1998**

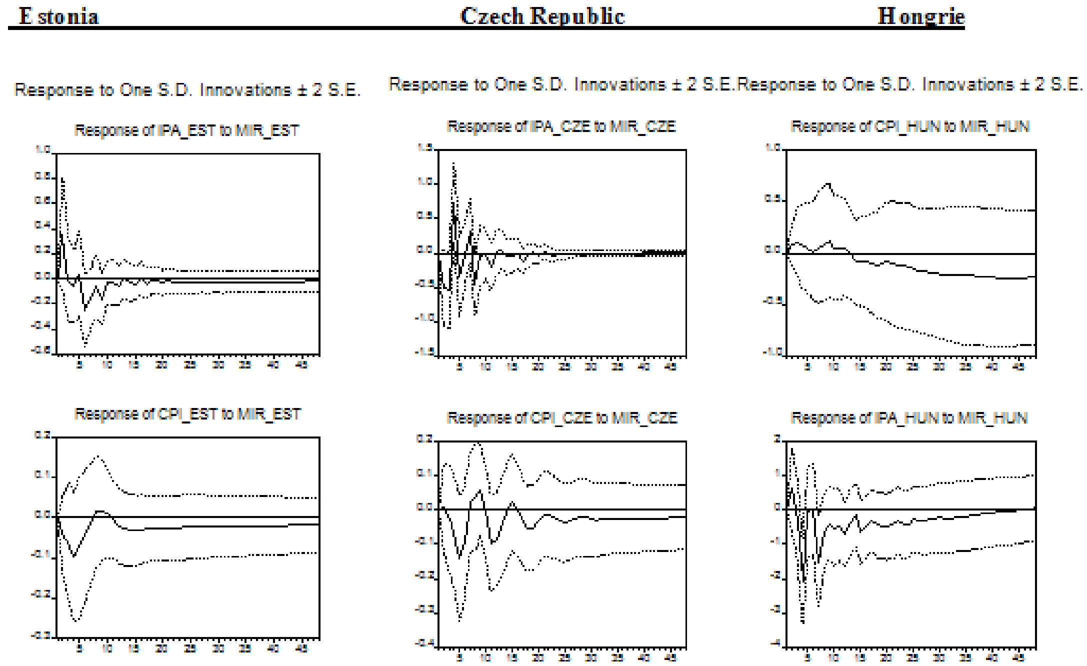

Figure 3: **Appendix IIc: Stabilization period 1999-June 2003**

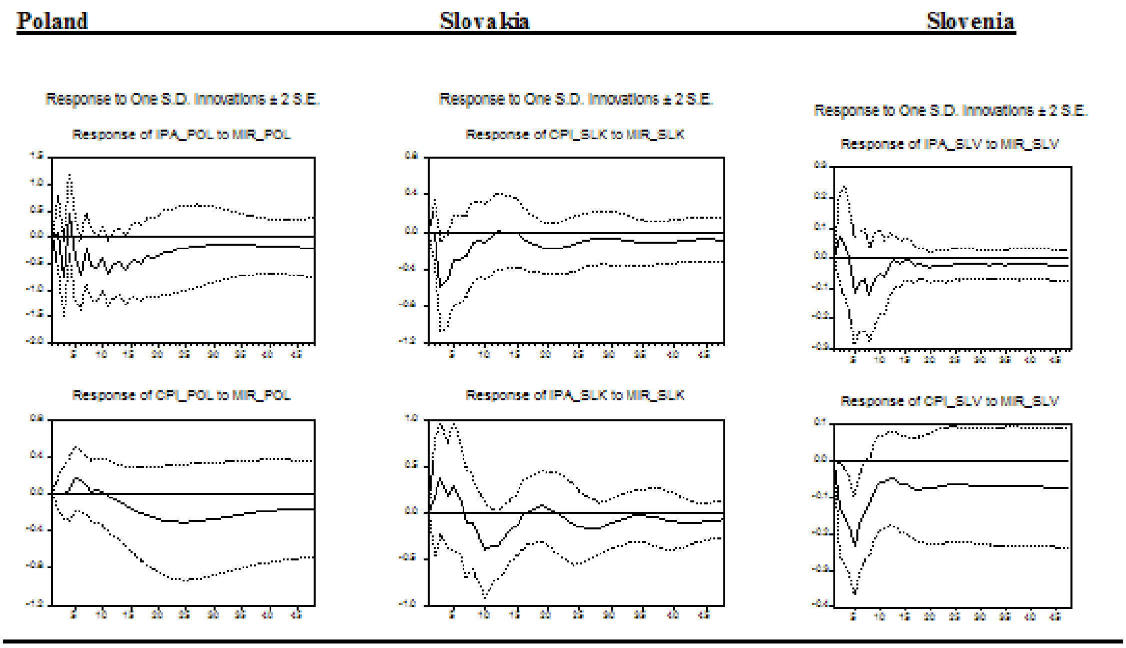

Figure 4: **Appendix IId: Stabilization period 1999-June 2003**